IN THE SPECIFICATION

Detailed Description of the Preferred Embodiments

The present invention is a method of exposure error adjustment automatically in photolithography, and drawbacks in the PFBS used nowadays are improved to enhance accuracy of exposure and promote product operation.

The invention utilizes the PFBS parameter calculation formula to evaluate an ~~adjustment~~ adjusted value of exposure, the PFBS parameter calculation for minor ~~miscellaneous~~secondary product is modified to link the primary or host product ~~exposed~~exposure, and the adjustment value calculation is thus ~~fit~~ modified for the real exposure condition. The reference database of minor ~~miscellaneous~~secondary product for adjustment value calculation is designed to be related to the adjustment value of the host product, and therefore exposure ~~of~~ for minor ~~miscellaneous~~secondary products is modified depending on exposure variation of host product.

Embodiment

~~It is assumed that the~~The host product is ~~mainly~~ defined as the primary product for which the manufacturing process, equipment, and software have been set-up and configured to produce, ~~processed~~ in ~~a~~ a multiple products manufacturing processes~~, and~~ Occasionally, various minor products are ~~added~~ scheduled into operations ~~alternately~~. The various minor products are ~~generally called~~ termed the ~~miscellaneous~~secondary products, and amount of ~~miscellaneous~~secondary product processed is much smaller than host product.

Because of the small amount of ~~miscellaneous~~secondary product processed compared to the amount of host product, the influence of the ~~miscellaneous~~secondary product on whole product operation is limited, and therefore the host product is not ~~apparently~~ noticeably affected by ~~miscellaneous~~secondary product. Thus, the host product utilizes formula (1) for PFBS parameter calculation to evaluate the PFBS parameter as ~~a~~ an exposure adjustment value directly. Referring to FIG. 2, a step 200 for choosing a suitable PFBS start value is performed

first. ~~The~~ Once a PFBS start value suited to the host product is chosen, ~~and~~ formula (1) is used to calculate the PFBS parameter for the host product. Formula (1) is given as:

$$PPs_{host,N}=PPs_{host,N-1}-g*B*(PPm_{host,N-1}-Target\} \quad \text{formula (1)}$$

Where "$PPs_{host,N}$" in formula (1) is the PFBS parameter of the "N" lot host product exposed.

Following Step 200, Step 220 for providing a standard point data of host product is then performed, and step 230 for providing a compensation difference data of host product is also performed. The standard point of host product is "$PPs_{host,N-1}$" in formula (1), and "$PPs_{host,N-1}$" is the PFBS parameter evaluated for the "N-1" lot host product exposed. That is, the "$PPs_{host,N-1}$" is the PFBS parameter evaluated of host product last processed.

The compensation difference of host product is the section after the minus sign "-" in formula (1), where "$PPm_{host,N-1}$" represents an actual measurement value of the "N-1" lot host product exposed, and the "Target" is an objective value predicted. The difference in value between "$PPm_{host,N-1}$" and "Target" represents an actual exposure error of host product last processed.

Further, "g" in formula (1) is a damping factor, and " B" represents a slope, "g" and "B" are related to setting condition of the exposure equipment; that is, the product of "g" and "B" is a ratio of the exposure adjustment value given for equipment setting to the actual exposure error. Therefore, the actual exposure error of host product last processed is combined with "g" and "B" to form an actual adjustment value difference considered in the PFBS parameter calculation between each lot operation.

However, because amount of host product operated is large, ~~miscellaneous~~secondary product is affected greatly by host product. For ~~miscellaneous~~secondary product, referring to FIG. 2, step 200 for choosing a suitable PFBS start value is also performed first. The PFBS start value suited to the ~~miscellaneous~~secondary product is chosen, and formula (2) is used to calculate the PFBS parameter for ~~miscellaneous~~secondary product. Formula (2) is given as:

$$PPs_{mis,N}=PPs_{host,cur}+offset_{mis,N} \quad \text{formula (2)}$$

Where "$PPs_{mis,N}$" in formula (2) is the PFBS parameter of the "N" lot ~~miscellaneous~~secondary product exposed.

Following Step 200, Step 240 for providing a standard point data of ~~miscellaneous~~secondary product is then performed, and step 250 for providing a compensation difference data of ~~miscellaneous~~secondary product is performed. The standard point of ~~miscellaneous~~secondary product is "$PPs_{host,Cur}$" in formula (2). The definition of "$PPs_{host,cur}$" is different from the standard point of host product, and the "$PPs_{host,cur}$" is the PFBS parameter evaluated of host product in ~~nearest current~~ the most recent operation, not the PFBS parameter evaluated of ~~miscellaneous~~secondary product last processed.

The compensation difference of ~~miscellaneous~~secondary product is included in "$offset_{mis>}N$" in formula (2). In addition to actual exposure error of ~~miscellaneous~~secondary product, the difference between host product and ~~miscellaneous~~secondary product is also included in the "$offset_{mis,N}$". Therefore, the "$offset_{mis,N}$" is composed of two parts and shown as formula (3):

$$offset_{mis,N} = offset_{mis,N} - g*B*(PPm_{mis,N-1} - Target) \qquad \text{formula (3)}$$

One part of the "$offset_{mis,N}$" is "$offset_{mis,N-1}$" in formula (3), and the"$offset_{mis,N-1}$" represents the difference between the "N-l" lot ~~miscellaneous~~secondary product exposed and host product; that is, the difference in the PFBS parameter evaluated between ~~miscellaneous~~secondary product last processed and host product in ~~nearest~~ most recent operation (i.e., "$PPs_{host,cur}$"). As ~~miscellaneous~~secondary product is processed in turn, the "$offset_{mis,N-1}$" value varies with the PFBS parameter variation of ~~miscellaneous~~secondary product. By definition, when processing host product, offset is set equal to zero.

Another part after the first minus sign "-" in formula (3) represents an actual adjustment value difference considered in the PFBS parameter calculation between each lot operation for ~~miscellaneous~~secondary product. Like formula (1), "g" in formula (3) is a damping factor, and " B"

represents a slope. "$PPm_{mis,N-1}$" in formula (3) is an actual measurement value of the "N-1" lot ~~miscellaneous~~secondary product exposed, and the "Target" is an objective value predicted. The difference in value between the "$PPm_{mis,N-1}$" and "Target" represents the actual exposure error of ~~miscellaneous~~secondary product last processed. Therefore, the actual exposure error of ~~miscellaneous~~secondary product last processed is combined with "g" and "B" to form the actual adjustment value difference considered in the PFBS parameter calculation between each lot operation.

By the definition of the standard point and the compensation difference, the actual exposure error of ~~miscellaneous~~ secondary product and the influence of host product on exposure condition are included in formula (2), and the PFBS parameter calculation for ~~miscellaneous~~ secondary product is dependent on exposure variation of host product.

As shown in FIG. 2, after the standard point and the compensative difference are provided, step 260 for evaluating the PFBS parameter value is then performed for host product or ~~miscellaneous~~ secondary product. Finally, the PFBS parameter evaluated is given to the exposure equipment as an adjustment value, and the exposure equipment adjusts exposure condition automatically.

In accordance with the present invention, and referring to FIG. 3, the PFBS parameter evaluation before each exposure operation for ~~miscellaneous~~ secondary product is based on the PFBS parameter of host product. As shown in FIG. 3, the solid line curve 310 and the solid line curve 330 represent the PFBS parameter variation of first-run and second-run for host product, respectively, while the dashed line curve 320 and the dashed line curve 340 represent the PFBS parameter variation of first-run and second-run for ~~miscellaneous~~secondary product, respectively.